The present invention relates to a method for transmitting data in a radio communication system, particularly in mobile radio systems with a broadband radio interface, also called UMTS (universal mobile telecommunication system).

Description of the Prior Art

In radio communication systems, data are transmitted via a radio interface using electromagnetic waves. The radio interface refers to a connection between a base station and subscriber stations, with the subscriber stations being either mobile stations or stationary radio stations. In this context, the electromagnetic waves are radiated at carrier frequencies situated in the frequency band provided for the respective system. For future radio communication systems, for example the UMTS mobile radio system or other 3rd generation systems, frequencies in the frequency band of approximately 2000 MHz are provided, with the bandwidth of a channel being 5 MHz.

By contrast, with systems like GSM (global system for mobile communications), a number of services which also can be transmitted in parallel is provided for the UMTS mobile radio system. Patent specifications EP 98 122 719 and DE 198 55 194 describe options for signaling the transport formats for the combination of data for a number of services. The data for a number of services on a connection are transmitted via a jointly used physical channel in this case.

The use of jointly used physical channels for transmitting data for a number of services on a connection to a subscriber station presupposes that a unique mapping specification indicates the allocation of the services to different segments of the physical channel.

By way of example, a physical channel is defined by a frequency band and a spread code (CDMA code division multiple access) within a frame.

The following terms are customary for describing the mapping specification:

Transport Format (TF):

A transport format defines a data rate, a coding, scrambling (interleaving), a data rate adjustment by puncturing and an error protection specification for a transport channel for a service.

Transport Format Set (TFS):

This denotes a set of possible transport formats which are permitted for a specific service.

Transport Format Combination (TFC):

This term indicates a possible combination of transport formats for the various services which are mapped onto a common physical channel.

Transport Format Combination Set (TFCS):

This denotes a set of possible TFCs as a subset of all TFCs which are permitted for a specific connection.

Transport Format Combination Identifier (TFCI):

This information item indicates the currently used combination of transport formats within the TFC.

In order to be able to select the currently used combination of transport formats for the various services in line with requirements, the TFC needs to be able to be changed, and hence the TFCI needs to be signaled regularly. This signaling ties up transmission capacity, however. The greater the number of possible combination options (TFCS), the more capacity is required for signaling.

In the case of the broadband CDMA system chosen for the FDD mode (FDD frequency division duplex) for the UMTS mobile radio system, when transmitting from the base station to the subscriber station in the downlink direction, the problem arises that the number of orthogonal spread codes which are useful is limited, which makes it more difficult to support variable data rates. Thus, with relatively high traffic densities in the system, it is not possible to allocate to all subscriber stations as many dedicated (i.e., used exclusively by the subscriber station) channels (DCH) as they need for transmission at their respective highest data rate.

For this reason, common channels, "shared channels" (DSCH downlink shared channel), are defined in the downlink direction, in this regard cf. ETSI, SMG2, UMTS-L1, Tdoc SMG2 UMTS-L1 559/98, dated November 9, 1998. The common channels are formed within the broadband frequency band by spread codes which are temporarily allocated to various connections or subscriber stations for the duration of one or more frames in each case. In this context, however, the problem arises of how it is possible to signal to a subscriber station with minimum complexity whether information is being transmitted for the subscriber station and, if so, in which of these common channels.

In addition, ETSI SMG2 UMTS-L1, Tdoc SMG2 UMTS-L1 559/98, dated November 9, 1998, discloses that the data rates for the services transmitted using time-division multiplex are signaled using the TFCI parameter, which is transmitted during each frame as part of the control information; i.e., in-band. To ensure rapid allocation of common channels, explicit signaling is proposed which uses a particular number of these TFCI bits exclusively for the purpose of indicating a particular spread code (cf. penultimate page).

This solution has the drawback that, as a result of this, for a given number of TFCI bits, the number of combination options for transport formats for the services is significantly limited, which has a considerable effect on flexibility when transmitting variable data rates.

The present invention is, therefore, directed to a method and a radio communication system which, when using common channels for a number of connections, increase the flexibility of resource allocation when transmitting variable data rates.

SUMMARY OF THE INVENTION

Accordingly, the present invention is based on the idea of implicitly signaling the used common channels using the data rate, and of permitting a number of combinations of channels (spread codes) as alternatives only for particular data rates for the individual services. This saves transmission capacity, because there is no need to reserve any individual bits within the TFCI parameter

just for allocating the common channels to different connections. The data rate is signaled in-band, with this information relating to the data rate not needing to be contained in full in each frame. Information from the connection context or from preceding frames likewise can be used for determining the data rate.

In accordance with one embodiment of the present invention, mapping the same combination of transport formats for the services onto various channels using the TFCI allows a very high degree of flexibility and can be achieved for minimum signaling complexity.

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The relationship between allocated data rate and common channels to be used is agreed in a separate signaling channel, so that the receiver is able to derive the chosen combination of channels, including one or more common channels, from the respective value of the TFCI parameter. This signaling of the relationship (mapping specification for the TFCI values onto stipulated combinations of the transport formats) advantageously occurs upon connection setup between base station and subscriber station. The data rate for the TFCI in-band signaling is high and uses considerable transmission resources. If it is possible to make savings here by virtue of generally valid agreements at the start of connection, then the number of TFCI bits required can be reduced, or the number of combination options can be increased.

The method according to the present invention and its advantageous developments give rise to the following advantages:

- With purely implicit signaling, there is no additional signaling complexity, wherein the available TFCI bits can be used exclusively for signaling the combination of data rates for the individual services with very fine granularity.
- Implicit signaling permits a high maximum transmission capacity to be allocated for each connection. The resultant dependencies of the possible data rates between the connections become less significant the more connections are involved and common channels are available.